TES Experiment Overview
&
INTEX-B Validation Flights

10/27/2005

TES Validation Team

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JPL

TES Primary Science Goals

Measurements of Tropospheric O_3 and precursors that will significantly improve our understanding of:

- Intercontinental Transport of Pollutants
- Tropospheric Chemistry
- Global O_3 Sources & Sinks
- Role of O_3 in Climate Forcing/Feedback

INTEX-B

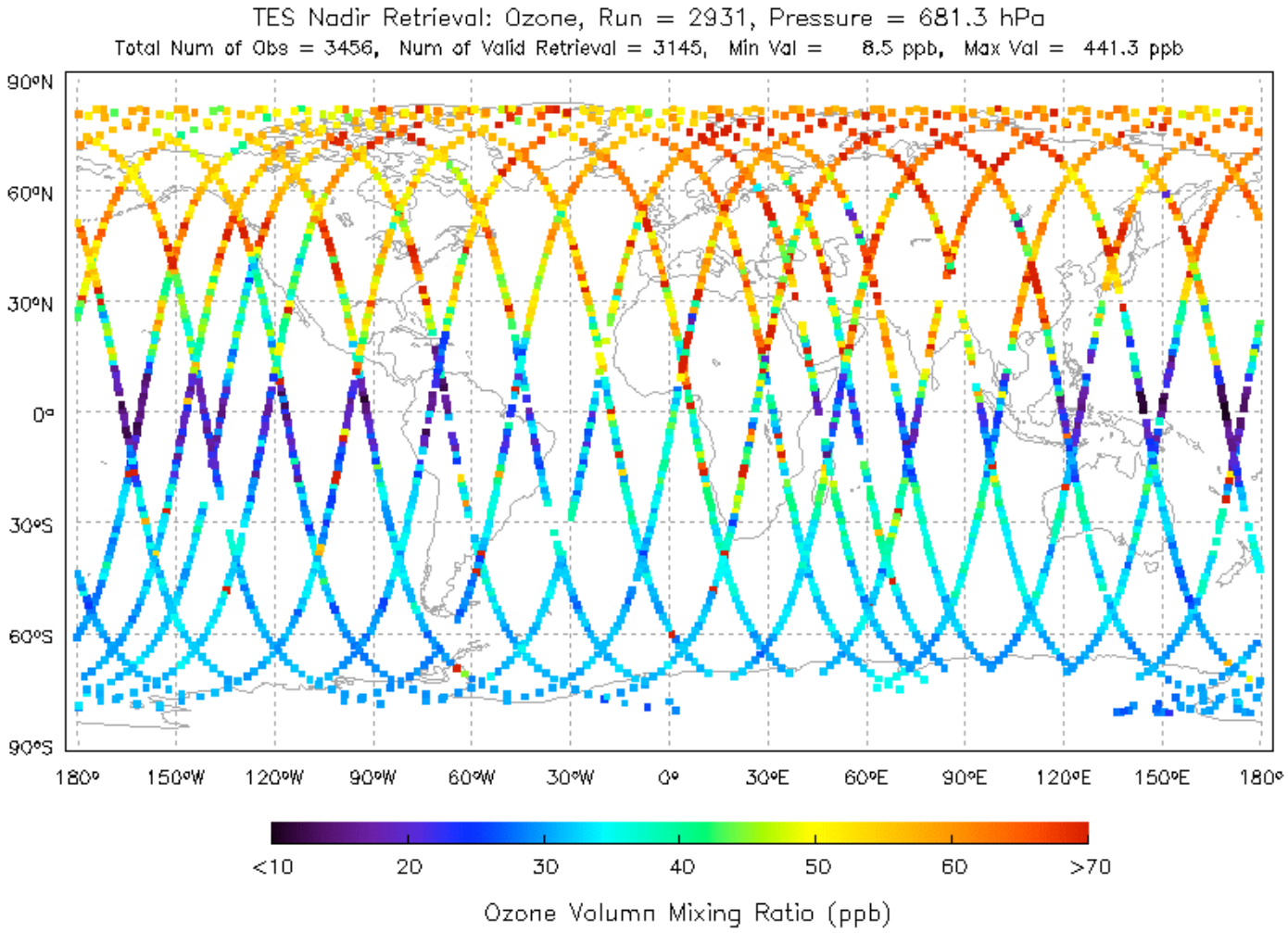
INTEX-B can provide:

- DC-8 aircraft measurements of tropospheric ozone, carbon monoxide and nitric acid.
- Significant number of profiles (remote and in-situ) to compare with TES data.

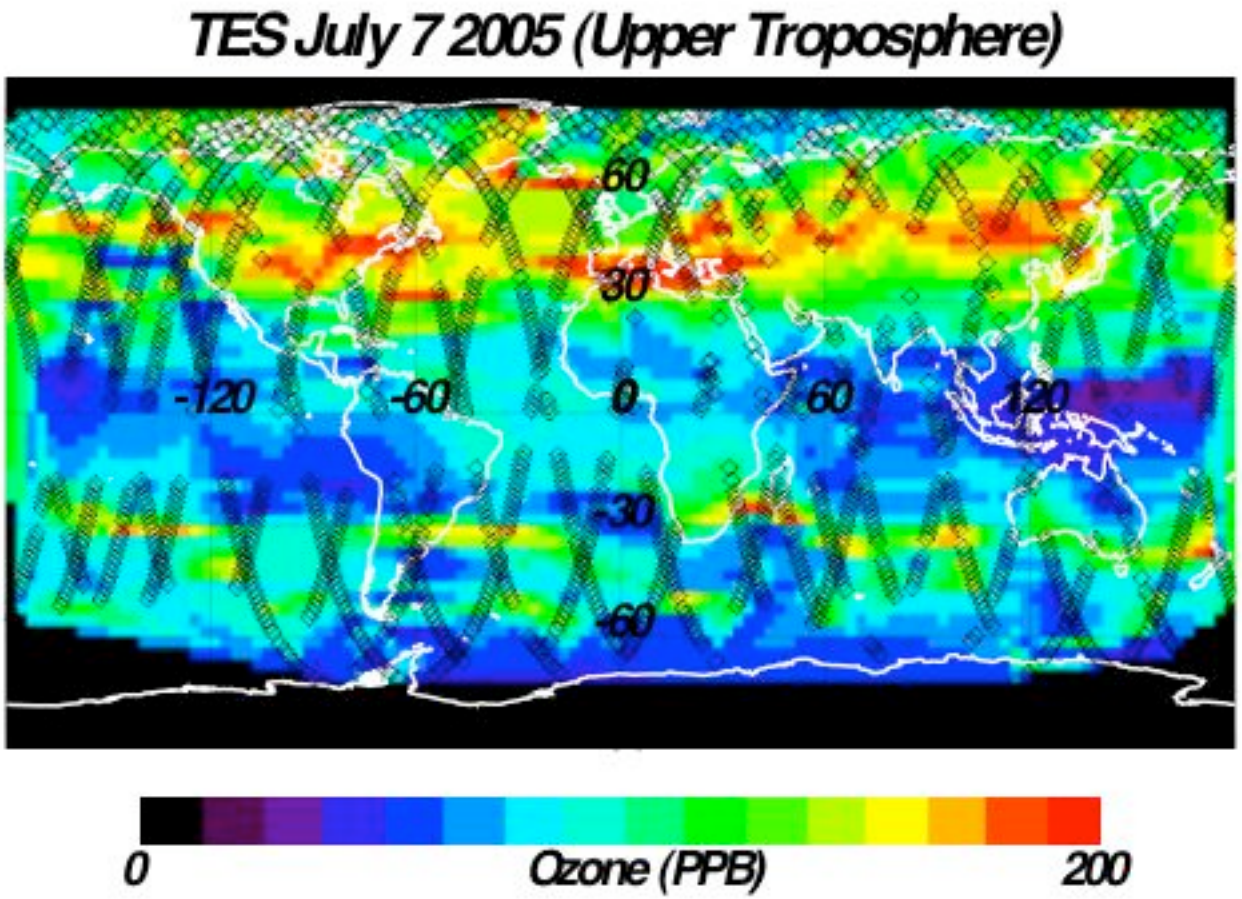
→ INTEX-B provides an ideal opportunity for obtaining data sets for validation and science analysis of TES data.

→ TES can provide global and regional data in areas of scientific interest during INTEX-B.

TES Global Survey (every other day): Separation of ~1.6° Between Nadir Scenes



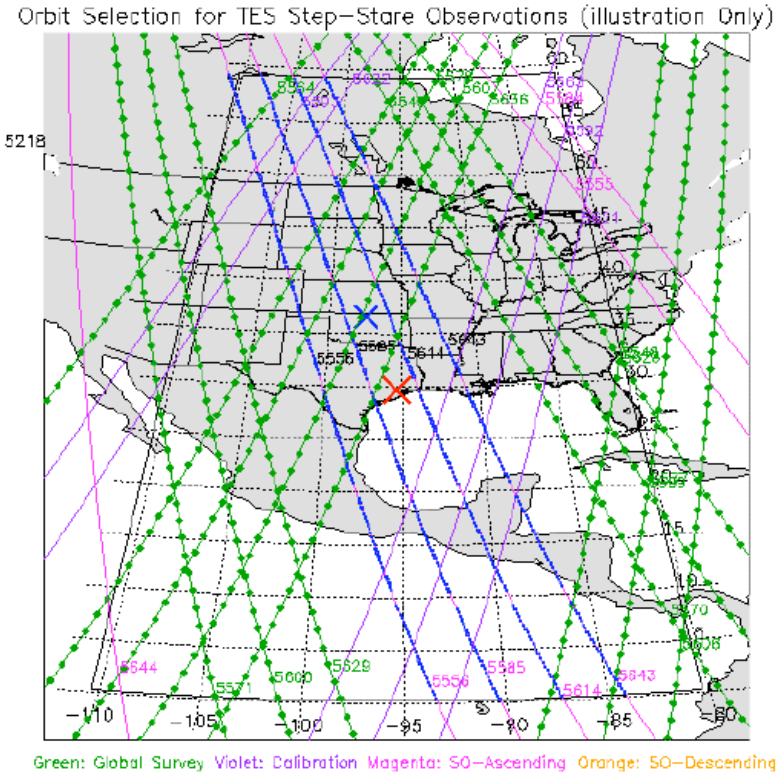
TES Global Survey as indicator of O_3 transport



(image provided by John Worden)

TES Special Observations

- The following three types of TES special observations can be scheduled for non-global survey days:
- **Step & Stare** (O_3, H_2O, CO)
  - Series of 150 nadir observations spaced 5.1 seconds apart (~34 km along the Aura nadir track).
  - Covers approximate 60 degrees of latitude.
  - Can be started at any latitude.
- **Limb** (HNO_3)
  - Series of limb observations.
  - Can be started at any latitude.
- *Combined* **Step & Stare and Limb** looking at the same air mass (under development)



Validation Goals for INTEX-B

- TES Validation Priorities:
  - Ozone
    - Lidar profiles of ozone under different atmospheric conditions during long, level flight legs along Aura orbit track
    - *In situ* profiles of ozone along the Aura orbit track.
  - Carbon Monoxide
    - Similar to ozone, getting *in situ* profiles under a variety of atmospheric conditions along the Aura flight track
  - Nitric Acid (Measured in the Limb)
    - Long level legs between 9-11 km, preferably along the TES limb track.

Validation Lessons Learned During AVE & PAVE Campaigns

- Aircraft flights along the Aura track are preferable on days that TES can make special observations.
  - TES Global Survey days are extremely difficult to change.
- Aircraft profiles from maximum altitude all the way down to sea level are highly desirable for the DC-8 *in situ* measurements.
  - Meaningful comparisons of TES with *in situ* data are very difficult unless the entire tropospheric profiles are available.
- Ozonesondes:
  - These have been, and will continue to be, a very high priority for TES validation.
- Variability of water vapor makes comparisons between TES and aircraft difficult. The best approach for water validation may be a statistical comparison between TES, AIRS, and sondes.

TES Measurement Status

- Global Surveys (with limb scans) taken Sep 2004 – Apr 2005
  - 73 16-orbit Global Surveys acquired with limb data
  - Nadir targets ~5° apart along orbit track (2 nadir scans averaged)
- Global Surveys without limb scans started May 2005
  - 3x more nadir targets, ~1.6° separation, no averaging of scenes
  - Limb mode still available for special observations, but removed from the Global Survey mode to preserve instrument lifetime.
  - No data for June 2005 since instrument was in safe mode.
- Step & Stare, Stare and Transect modes used for special observations
  - AVE (Oct 2004 – Nov 2004)
  - PAVE (Jan 2005 – Feb 2005)
  - S. Atlantic (Sep 2004 – Oct 2004, Jan 2005 – Feb 2005)
  - N. America (July 31, 2005 – August 6, 2005)
  - Lake Tahoe: Stare mode for geolocation, radiance val. (Aug 05 – Sep 05)
  - S. America: biomass burning transects (Aug 2005 – Sep 2005)

TES Data Availability

- Current TES data at the Langley ASDC is a Beta version (v001)
  - Nadir scenes only.
  - L2 retrievals from special observations to start delivery Oct 2005.
  - Caveats listed for L1B calibration and L2 land retrieval issues.
  - Files in HDF format
- Data taken during AVE 04 and PAVE 05 (limited) is available at the Aura Validation Data Center (AVDC).
  - Data is in IDL “Save” file format
- Next release (v002) in Spring 2006
  - L1B calibration improved substantially & validated
  - Will include limb retrievals (with HNO3)
  - HDO product added for nadir views

Data Quality of TES Data (v001)

- Level 1B:
  - TES L1B data products have systematic errors that will be fixed in v002 data.
    - Systematic errors are estimated after radiometric calibration and show an average radiance error of approximately 2% .
    - Errors specific to each target spectrum are available within the data products.
- Level 2:
  - TES L2 products that are ready for scientific use are nadir retrievals of ozone, carbon monoxide, temperature and water for ocean target scenes.
  - Caveats on TES L2 Products:
    - Land scenes are reported but should be used with caution due to a software bug.
    - TES L2 retrievals over the Sahara desert regions have problems with the a priori estimates of emissivity and should not be used.
    - Retrieved parameters poleward of 60 should be used with caution due to the low brightness temperatures associated with these scenes.
    - As a means of accounting for systematic errors in L1B radiances, current L2 profiles include the retrieval of a calibration scaling parameter.
  - The error estimates included in the L2 data products are meaningful based on the current validation analysis.

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